Example 2

(building on Example 1)

$$\ddot{y} + a_1\dot{y} + a_0 y = u \qquad \Longleftrightarrow \qquad s^2 Y + a_1 s Y + a_0 Y = U$$

$$\text{or} \qquad Y(s) = \frac{U(s)}{s^2 + a_1 s + a_0}$$

Always solve for the highest derivative:

$$\ddot{y} = \underbrace{-a_1\dot{y} - a_0 y + u}_{=v}$$